

# RX J1301.9+2747: A Highly Variable Seyfert Galaxy with Extremely Soft X-ray Emission

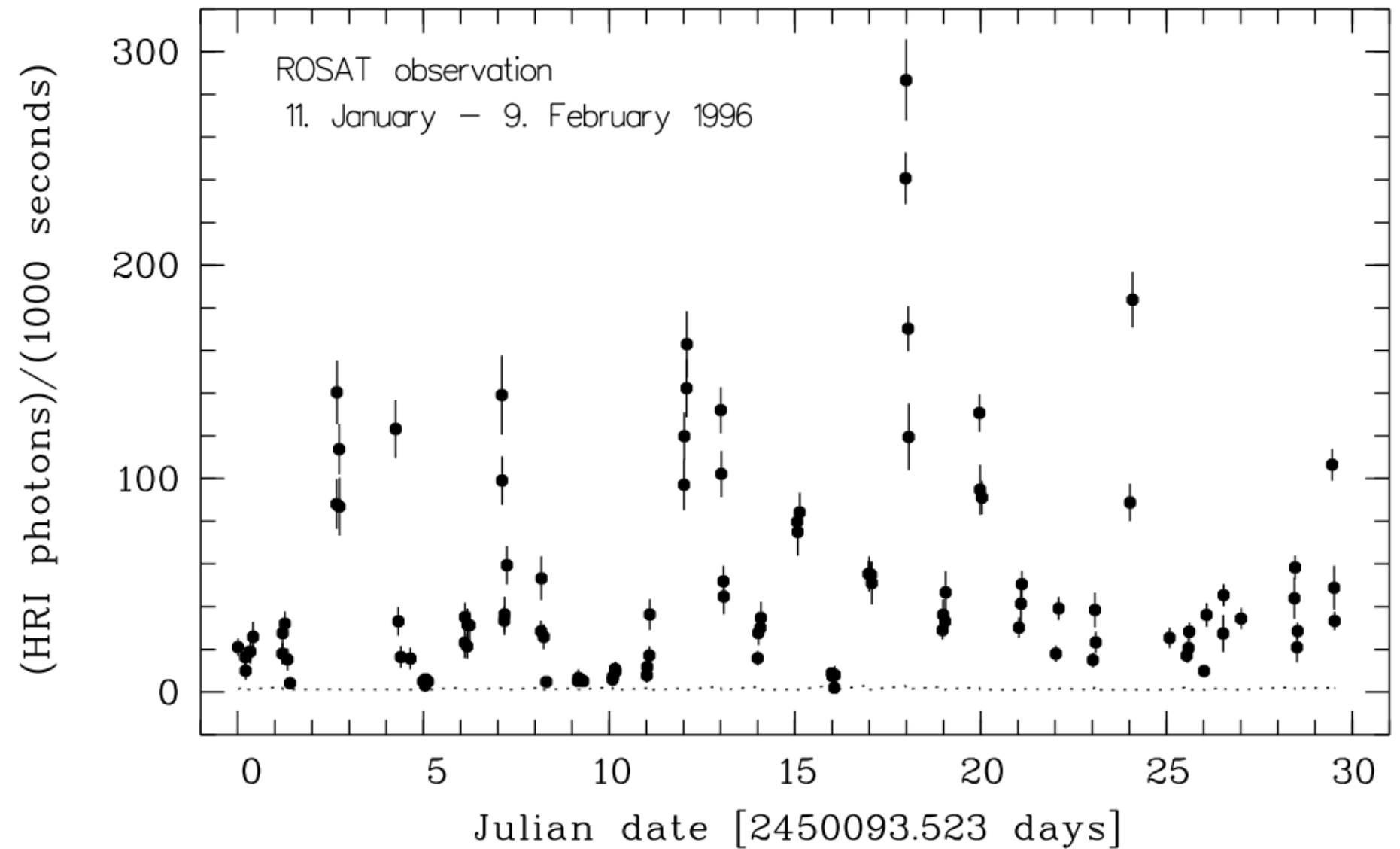
舒新文

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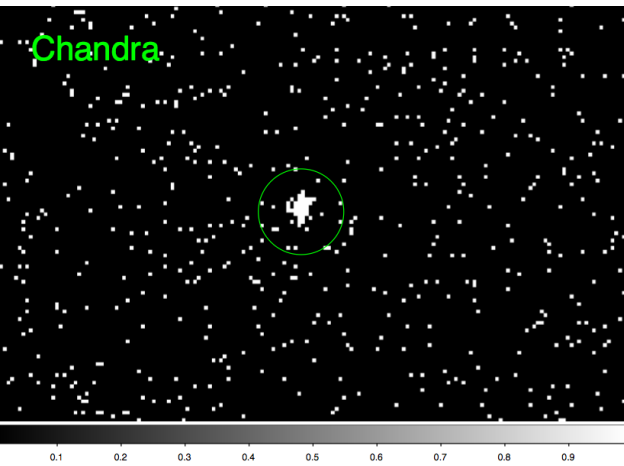
April 18, 2013, “Einstein-Probe” 卫星科学目标研讨会, NAOC

For more details, please see <http://arxiv.org/abs/1304.3244>

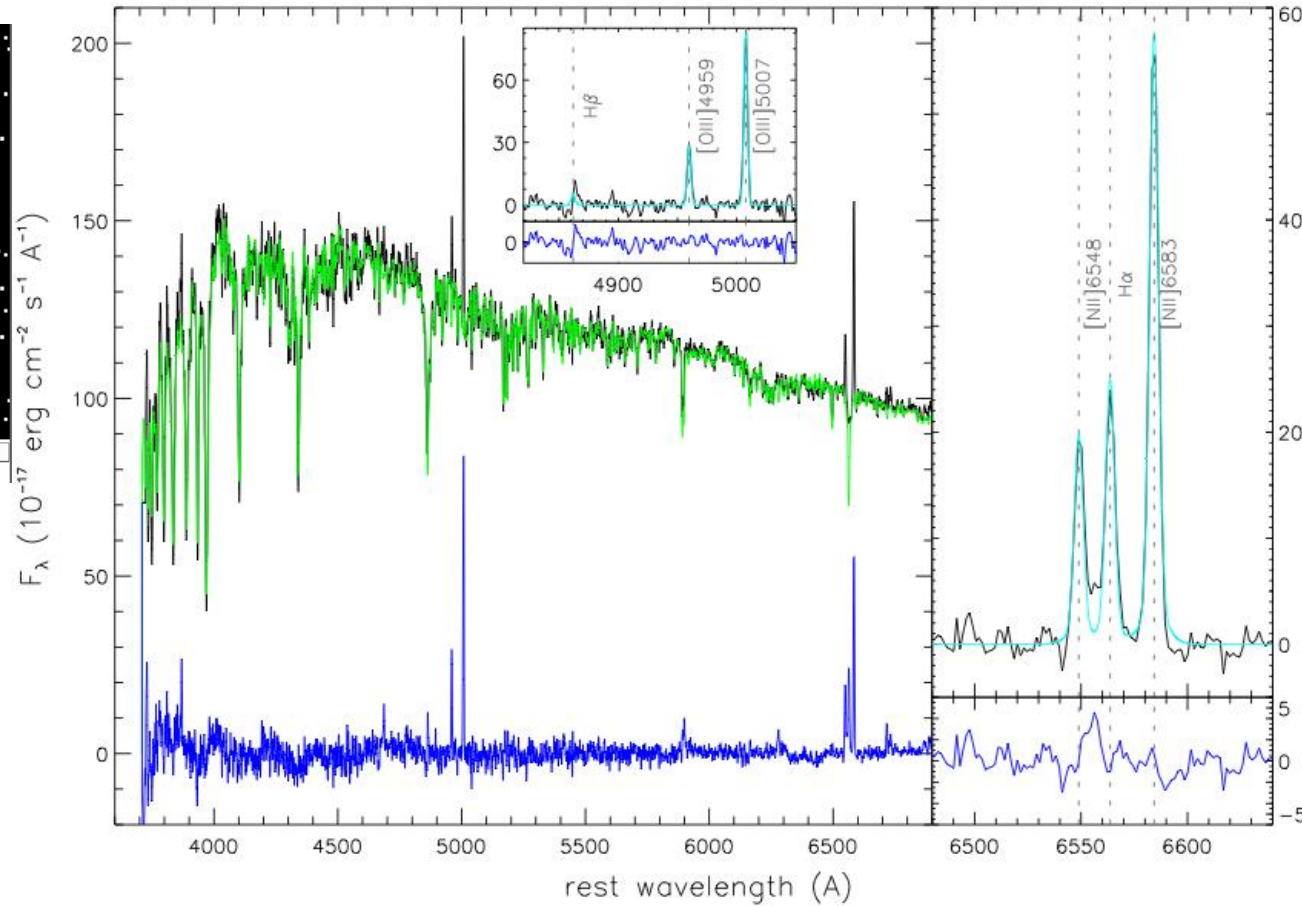


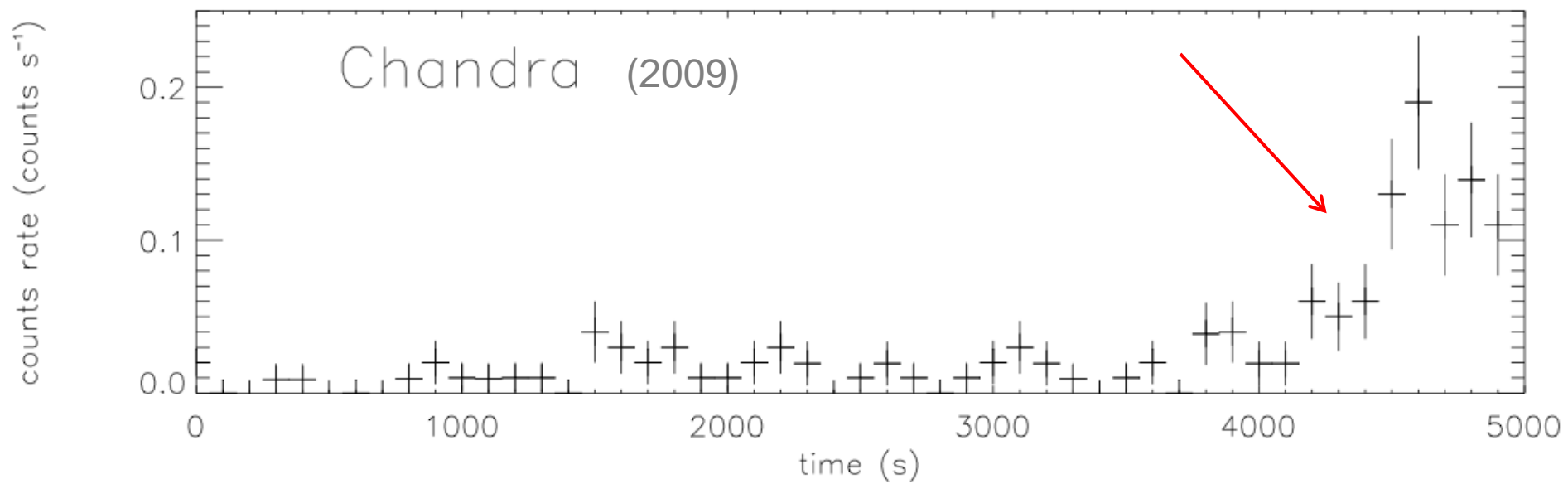
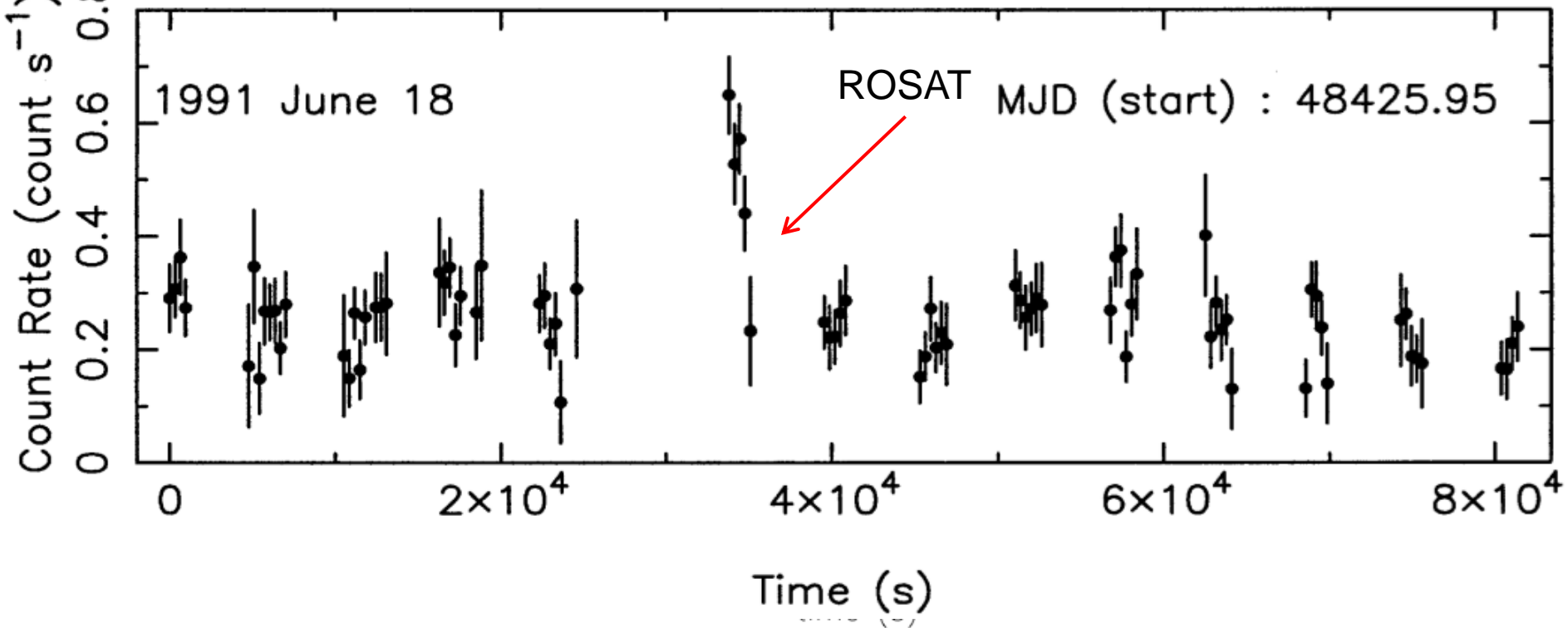
extreme and persistent X-ray variability in IRAS 13224-3809, a factor of 60 in just 2d, Boller+97

# RX J1301:9+2746: a post-starburst Seyfert galaxy

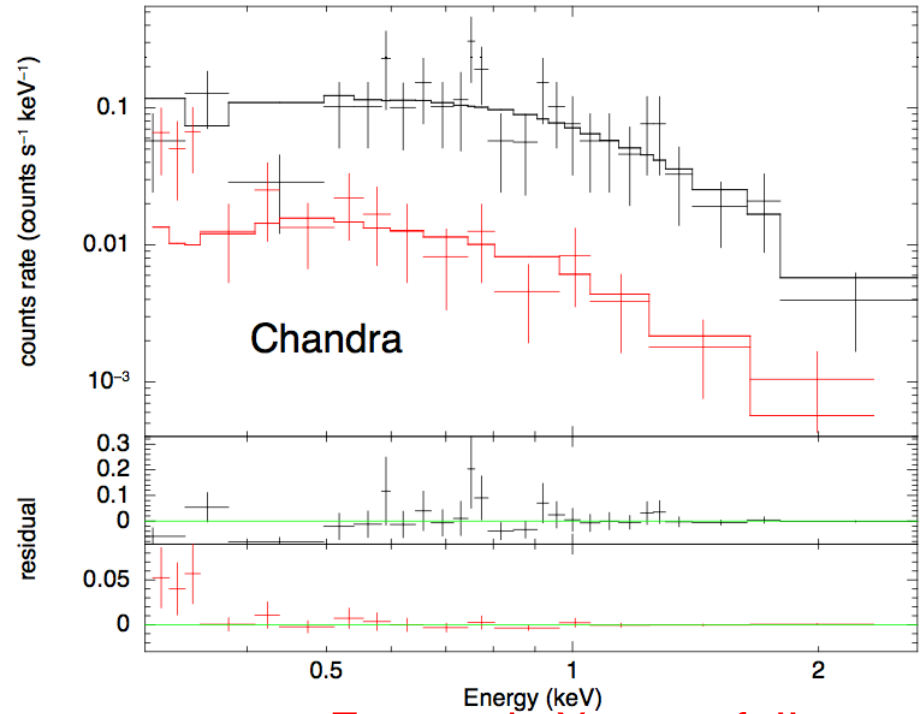
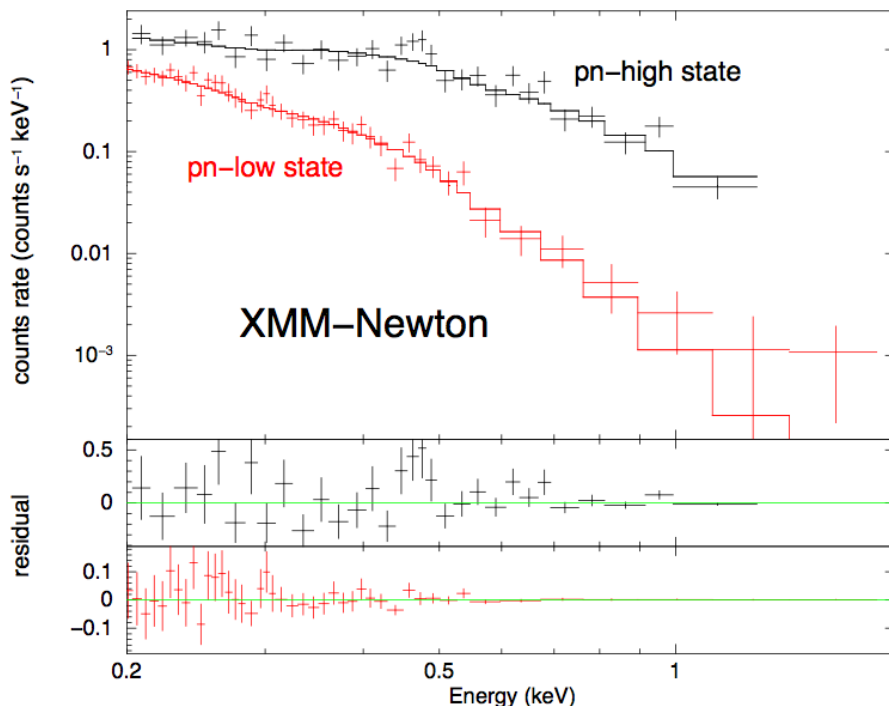


Clearly detected  
by Chandra and  
XMM





# XMM and Chandra spectra



Extremely X-ray soft !!

XMM-pn low state

wabs*model	$N_{\text{H}}/10^{20} \text{ cm}^{-2}$	$\Gamma$	kT/eV	$\chi^2/\text{d.o.f.}$
pow1	$3.6^{+1.9}_{-1.6}$	$7.1^{+0.9}_{-0.7}$		27.9/40
bbbody+pow1	0.75(fixed)	$4.3^{+1.6}_{-1.9}$	<u><math>43^{+6}_{-3}</math></u>	26.3/39

XMM-pn high state

wabs*model <sup>a</sup>	$N_{\text{H}}/10^{20} \text{ cm}^{-2}$	$\Gamma$	kT/eV <sup>b</sup>	$\chi^2/\text{d.o.f.}$
pow1	$4.3^{+2.2}_{-1.8}$	$4.4^{+0.5}_{-0.4}$		40.4/28

# Thermal emission from AD?

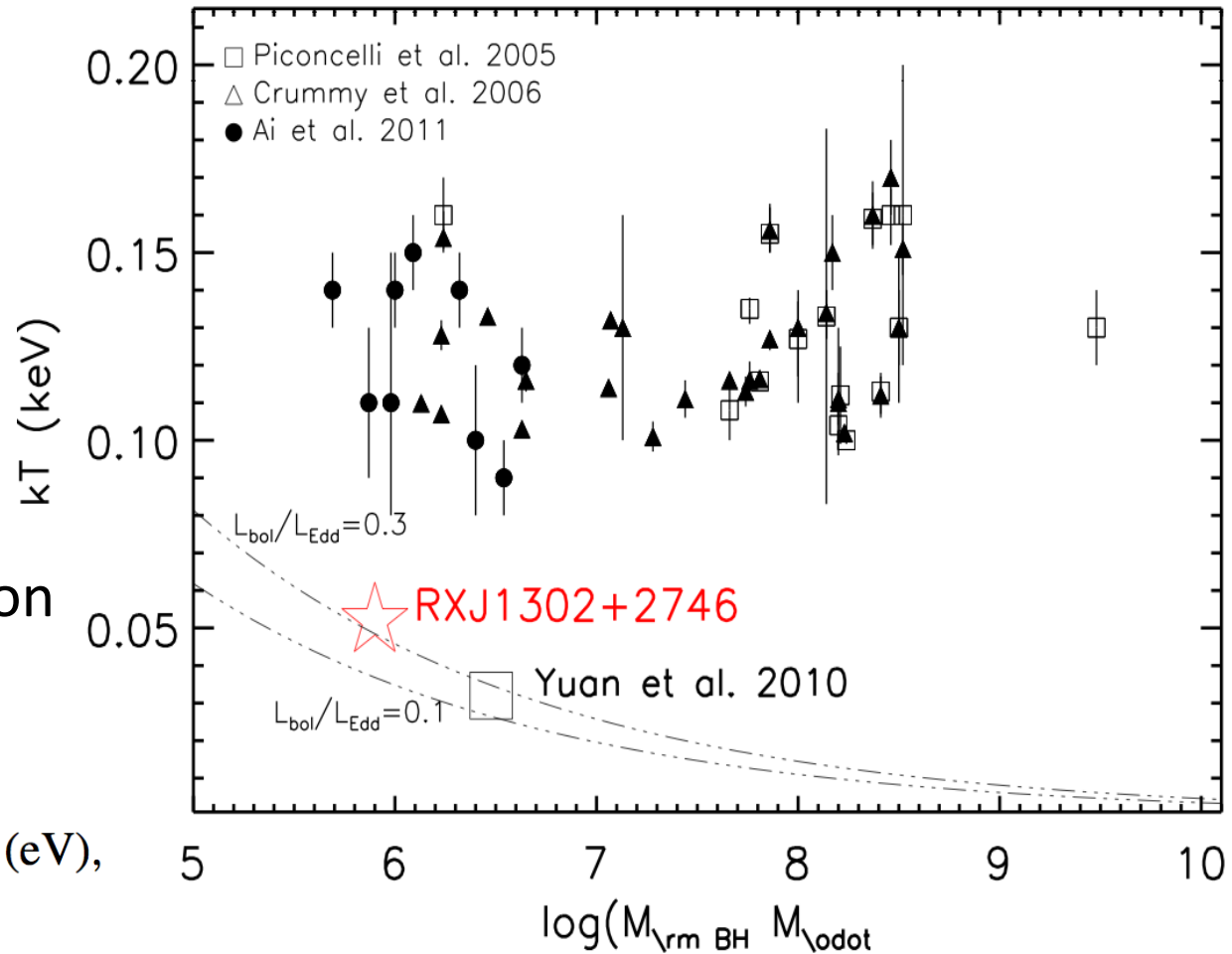
BH mass (from [O III]):

$\sim 8 \times 10^5 M_{\text{sun}}$

Eddington ratio: 0.2

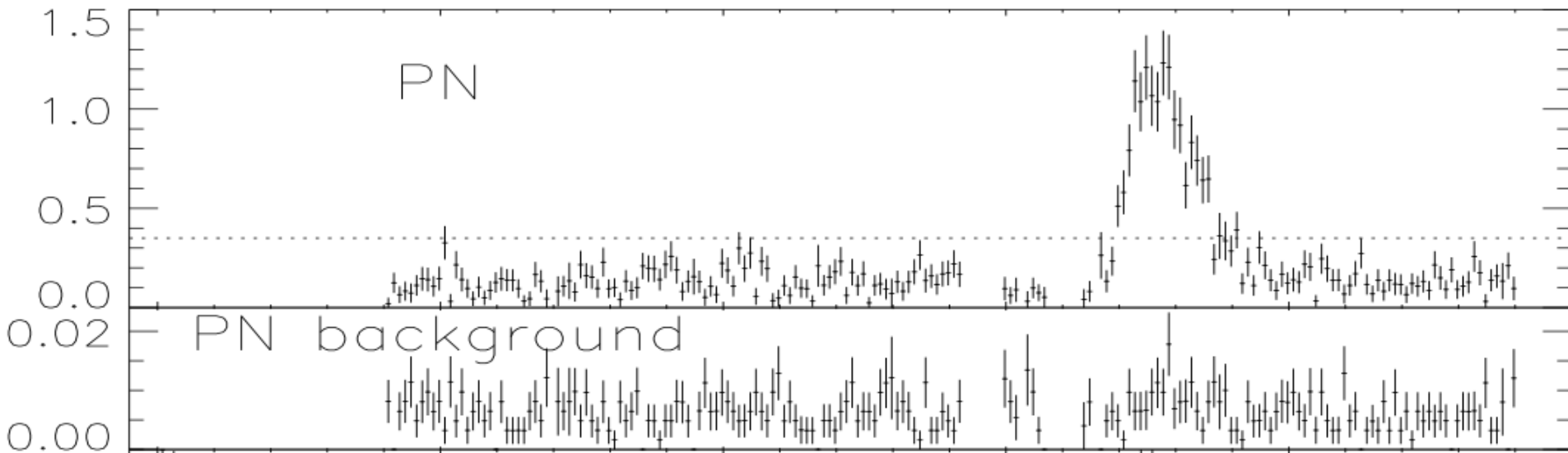
Can self-consistently  
described by thermal  
emission from an  
optically thick accretion  
disc around a SMBH.

$$T_{\text{max}} = 11.5 \left( \frac{M}{10^8 M_{\odot}} \right)^{-1/4} \dot{m}^{1/4} \text{ (eV)},$$



# Referee's report:

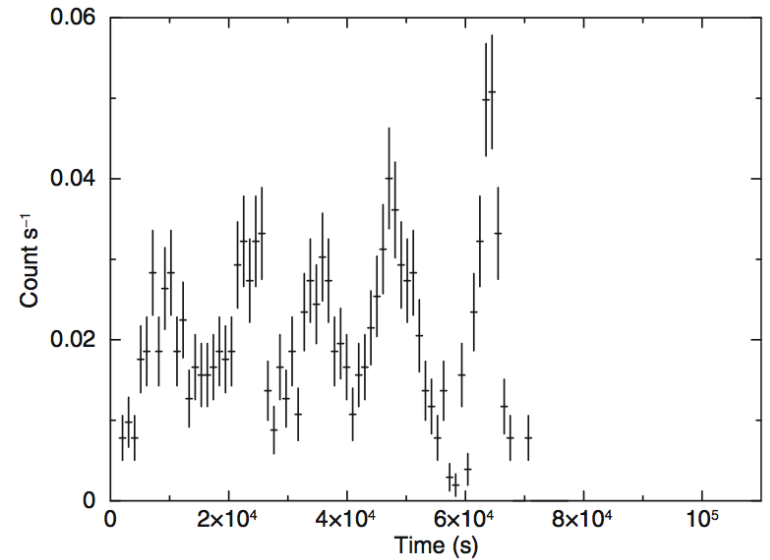
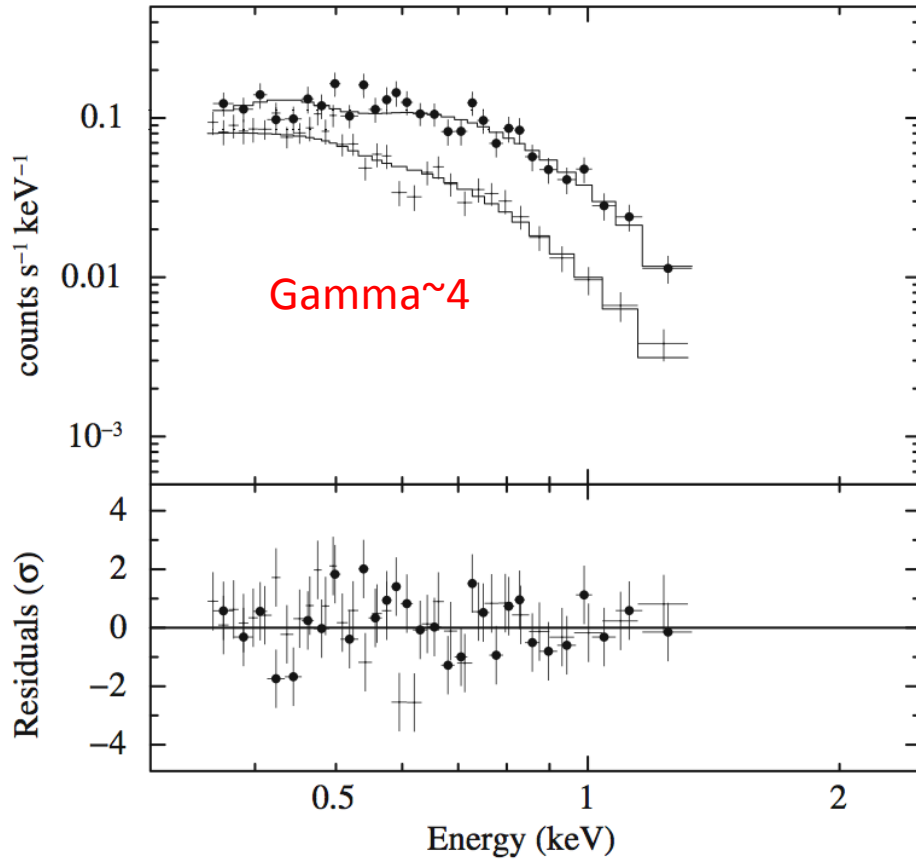
....None of known AGNs show similar combination of characteristics, and the object presented in this paper will have impacts on various related fields including accretion physics, spectral states in AGNs, and scaling between AGNs and stellar mass black holes, and so on. ....



Are there more other AGNs similar to RX J1302+2746?

# 2XMM J123103.2+110648

Terashima+12



Model <sup>a</sup>	Parameters	Observation 2	
		High Flux	Low Flux
MCD	Absorption <sup>b</sup> ( $10^{20} \text{ cm}^{-2}$ )	$13 \pm 8$	0 (<4)
	$kT$ (keV)	$0.18 \pm 0.03$	$0.18^{+0.01}_{-0.02}$

$$L_{\text{bol}}/L_{\text{Edd}} = 0.45 \left( \frac{10^5 M_{\odot}}{M_{\text{BH}}} \right).$$

To cause Comptonization,  $L_{\text{bol}}/L_{\text{Edd}} \sim 0.3$ , (Done07) -

$\rightarrow M_{\text{BH}} \sim 1.5 \times 10^5 M_{\text{sun}}$  (Ho et al. 2012, Magellan spectrum)



# Evidence of persistent X-ray flare has been observed in AGNs

## *Physical interpretations:*

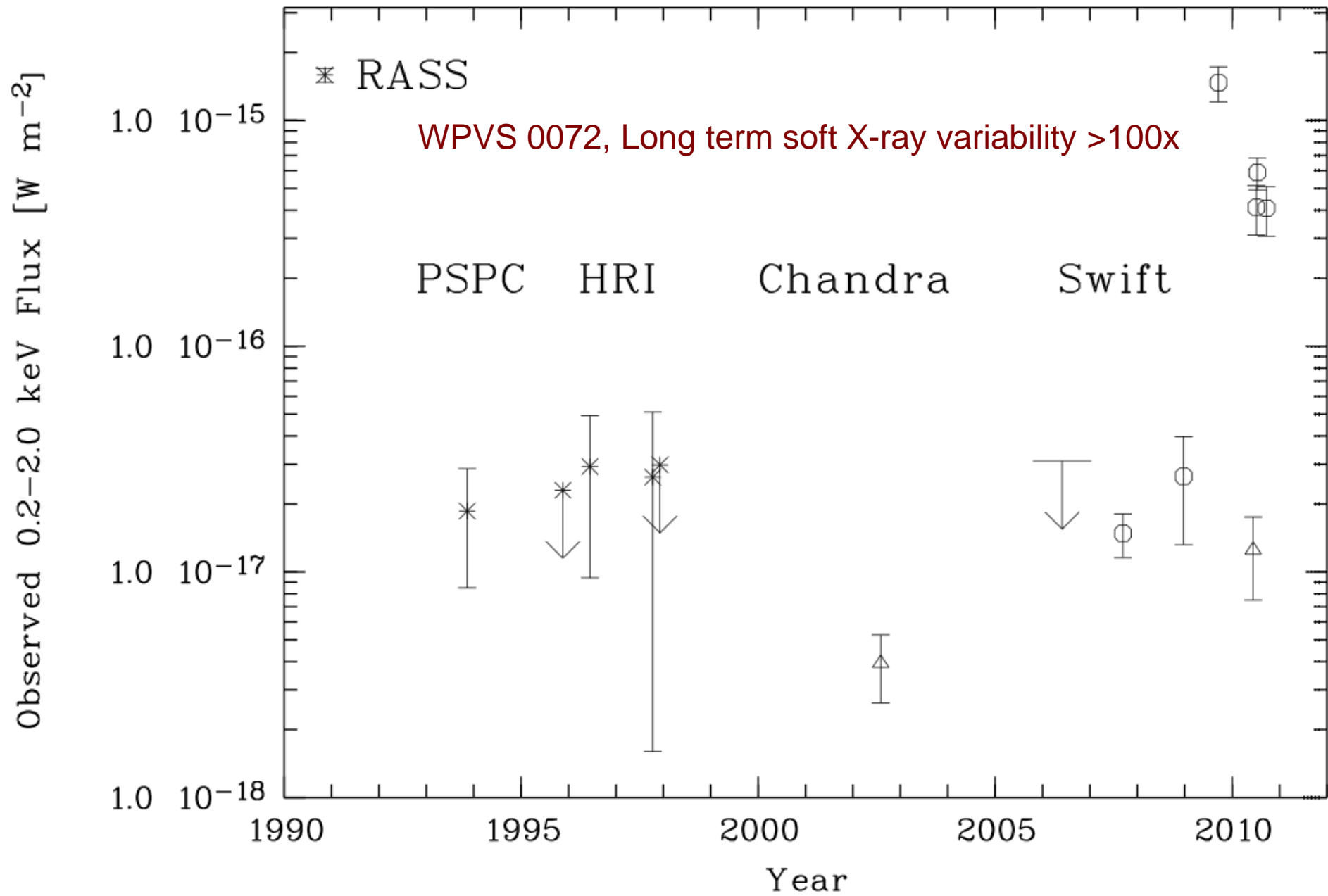
- 1. Magnetic reconnection in corona*
- 2. Accretion rate variations*
- 3. Soft-excess temperature changes*
- 4. Relativistic effects*
- 5. Gravitational lensing*
- 6.....*

Discovery(EP)→Multi-band followup

## *Science aspects:*

- 1. New aspects of physics of BH accretion*
- 2. Characteristics of corona, jet formation?*
- 3. Physical connection between AGN and stellar X-ray binaries*
- 4. Structure of AGN central engine*
- 5.....*

large amplitude AGN variability  
( $>20x$ ) on longer time scale



Normalized Counts  $\text{s}^{-1} \text{keV}^{-1}$

$10^{-4}$

$10^{-5}$

$10^{-6}$

0.5

1

2

5

Energy [KeV]

Absorption that causes the extreme X-ray flux variation  
in WPVS 0072, Leighly+08, Grupe+08

